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Self-organisation and Spatial Planning: an Editorial Introduction

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Why self-organisation matters to planning?

Spatial planning and self-organisation are perhaps a somewhat unexpected combination, with planning being a collective manifestation of 'intent', while self-organisation is a 'spontaneous' phenomenon. Nevertheless, this combination has recently been receiving serious attention from the planning community (Boonstra & Boelens, 2011; Portugali, 2011; Moroni, 2015; Zhang et al., 2015). They build on the pioneering work of scholars such as Allen (1997) and Portugali (2000). There are a few empirical reasons for this increased attention, such as the global housing, mortgage and financial crisis challenging civil societies to develop alternative planning practices (Cohen, 2010, Sanfrey, 2010): the repeated failures of large planning projects (Flyvbjerg et al., 2003; Priemus, 2010); the development of the network society and more horizontal and hybrid forms of collaboration – requiring alternative views on how urban transformation processes are shaped (Castells, 2010); and, the rise of the post-policy society (Boonstra, 2015), which comes with a rapid increase of collective actions and civil initiatives. These are all important factors in considering seriously autonomous and spontaneous processes within the realm of spatial planning. Such projects, initiatives and actions cannot be treated as isolated activities, which in turn confront planners with a highly interconnected world evolving through unprecedented non-linear chains of causes and effects and through spontaneous pattern formations beyond the control of traditional planning mechanisms. This growing awareness of a world beyond the planners' control, evolving in various autonomous ways, is now being explained by emerging theories which address complexity, non-linearity, adaptability, co-evolution, transition and self-organisation.

Clearly, the world in which planners operate has always included self-organising processes: the autonomous formation of economic agglomerations resulting from similar types of activity at the local level, the densification of residential areas through self-building behaviours, the formation of pedestrian flows in crowed public spaces, the development of informal settlements, and even the co-evolutionary path of institutional revision in response to these unplanned spontaneous changes. These processes never received much attention and did not become part of mainstream planning. Self-organisation was just there and did not relate much to the planners' language of control, regulation and rationality, nor to the planners'

drive to reach consensus and shared responsibility. Therefore, a question arises whether self-organisation matters in understanding spatial development processes and in supporting planners to address a world progressing beyond their control.

Here, we adopt the position that self-organisation processes do matter and are relevant to planning. We argue that understanding these processes can support planners in dealing with a reality which evolves spontaneously, in interaction with or independent from the intended changes. Fundamental to self-organisation processes are 1) the occurrence of a symmetry break, 2) reaching a critical point, 3) followed by a non-linear process of adjusting behaviour by independent agents, resulting in 4) spontaneous patterns emerging at specific times, revealing the complementary actions of all agents together (De Roo, 2016; see also Boonstra, 2015). A symmetry break usually occurs with criticality, which means that only at the moment criticality is reached will it result in a cascade of independent individual actions: Bak's experiments (1999) on piles of grain made this observation quite famous. Initially, these individual actions can look like nothing more than chaotic or random behaviour: a period of no identity. However, at some point a collective pattern can come to the fore spontaneously: an order emerging from chaos.

Essential to the understanding of self-organisation is the realization that it is *not* a centrally organised process. There is *no* intended collective action in the period of no identity and there is *no* way to predict the extent of the effect of the process: the result can be a substantial or a minimal spatial and/or social pattern, or something in between. Whatever the result is, however, the moment it is there it represents a new reality to which agents refer, relate to and build upon. Therefore, our argument is that the notion of self-organisation cannot be ignored if we want to enhance our understanding of urban development patterns, decision-making processes and the interdependencies between structuring institutions and creative agents.

Social sciences face a difficult task in identifying the four steps we consider part of self-organising processes. In contrast with the hard sciences and their focus on isomorphic environments, self-organisation processes in the development of neighbourhoods, cities and regions are part of a plural world. Criticality in a social environment will not, for example, represent one dominant factor after which an immediate change will occur. Instead, criticality will be a fuzzy or fluid moment likely to be identified after the elapse of a period of adjustment behaviour. Moreover, the behaviour of agents in self-organising processes in socio-spatial contexts is guided by generally accepted and situation-dependent social values, conventions and norms. Analysing the extent to which these values, conventions and norms constrain or enable processes of self-organisation into spontaneous pattern formation is a process of interest here. In this Special Issue our aim is to explore the characteristics and mechanisms of self-organisation in urban transformation processes. This Special Issue raises the question of how to consider various conceptualizations of self-organisation in the theoretical planning debates and planning practices in various international contexts.

Self-organisation in a non-linear world

The process of self-organisation is spontaneously evolving, giving rise to new structures, patterns or organisations within a system or a network as a result of interactions between elements, parts, agents or actors which are not externally controlled, coordinated or regulated (Nicolis & Prigogine, 1977; Bonabeau et al., 1997; Bak, 1999; Heylighen, 2008). Initial and contextual conditions are important in these processes, as are the presence of fluctuations and positive and negative feedback loops. These characteristics have been identified within physical, chemical, biological, ecological and social systems (e.g. Haken, 1983; Nicolis & Prigogine, 1977; Camazine, 2003; Holling, 2001; Fuchs, 2003).

Self-organisation also attracts attention within economics. As early as 1776, Adam Smith's 'invisible hand' referred to a self-organising mechanism guiding and shaping economic systems (Smith, 1937 [1776]). Krugman (1996) illustrates the economic consequences of self-organisation: 'Self-organisation is something we observe and try to understand, not necessarily something we want' (Krugman 1996: pp. 5–6). This reflection highlights that the accumulated effects of individual actions (the parts) can contribute to desired innovations as much as to crises, such as the global credit crisis which began in 2008 (Arner, 2009).

In the post-war period, the concept of self-organisation was reintroduced by W. Ross Ashby's work (1947) on cybernetics. However, self-organisation did not attract much attention beyond the discipline of cybernetics until Prigogine and Nicolis (1977) presented the dissipative characteristics of self-organisation. Dissipative systems adapt and self-organise through their interactions with their environment, and the exchange of matter, energy or information is a consequence of this. Systems exist, persist and even progress while being out of equilibrium, in a flow (of multiple agents) through which interactions between systems or networks and within systems or networks result in spontaneous pattern formation. Self-organisation plays a key role in the emergence of these patterns.

Prigogine's work opened up a wonderful world of non-linear relationships, with surprising examples ranging from self-organising Bénard cells (also known as Rayleigh–Bénard convection: Getling, 1998; Koschmieder, 1993) to fractural structured cities (see simulations created by Batty, 2005; Torrens, 2012). Prigogine's work is supported by additional ideas from Hermann Haken (1983) and his theory of synergetics. While Prigonine stresses external interactions, Haken's synergetics explains interactions within a system. Energy, matter and information are absorbed, used, transformed and communicated at system level, resulting both in stable phases and dynamic phase transitions. Through self-organisation processes among subsystems, the system as a whole displays increased pattern formation, which we perceive as 'order'. Maturana and Varela (Varela et al., 1974) explained through their model of autopoiesis how subsystems are capable of reproducing and maintaining

themselves. While these subsystems are considered as functioning more or less autonomously, they are nevertheless 'structurally coupled' with the system's environment.

Within the social domain, self-organisation has been an inspiration for various proposals, for example self-organising communities (Luhmann, 1982), explaining the use of urban networks (Batty and Longley, 1994), and linking the idea to Giddens's structuration theory (Fuchs, 2003). These and many other ideas contribute to, or build on, the notion of self-organisation within a social world.

Self-organisation has lent itself strongly to interpreting various complex issues, providing an alternative understanding of change and transformation. It contrasts with a Newtonian, mechanistic and linear world of certainty, control and regulation. Self-organisation is part of an alternative, non-linear world view, with processes of emergence and co-evolution, and with adaptive behaviour as a response to external influences. A non-linear world view results in a relational understanding of space and time. The consequence is that we have to consider reality as situational and therefore linked to a specific moment in time and location in space. Arriving rather late to the party compared to many other scientific disciplines, spatial planning is now opening itself up to this new thinking, and the application of self-organisation has emerged as an issue which is rapidly attracting the interest of planners. So will the notion of self-organisation enhance our understanding of spatial development processes?

Although some exciting achievements have been made using self-organisation as an alternative perspective to cope with the increasing awareness of uncertainty in the discipline of spatial planning (Byrne, 2003; De Roo, 2010; Portugali 2000, 2011; Boonstra and Boelens, 2011; Moroni, 2015), many related questions which need clarification and further study remain unaddressed. This special issue is therefore an effort to bridge understandings of self-organisation and spatial planning and demonstrate how self-organisation can contribute to planning theory and practice. We present a collection of innovative research papers studying fundamental questions related to self-organisation and spatial planning.

The scope of the special issue:

The set of papers presented in this special issue is structured along three main topics:

1) Building and bridging various understandings of the concept of self-organisation

Mankind itself epitomizes the phenomenon of self-organisation. We argue that nobody's actions can be fully determined by a predefined master plan to which that person has to respond. In spatial planning, however, the understanding of reality which embraces the idea of command and control hasbeen dominant in most parts of the world, particularly in the West. In a command-and-control reality planners are being viewed as creators of place, producing the optimal plans and top-down regulation based on facts and predictions. The turn towards

communicative approaches has resulted in additional practices that are more in support of self-regulation processes. 'Communicative planning' replaces a factual reality with an agreed reality. However, again it considers reality as a fixed product in time, but now created from stakeholder consensus. Both the command-and-control rationale and the communicative rationale contrast with, and even oppose, autonomous, adaptive, transformative, emergent and self-organising behaviour. As a result, planning scholars and practitioners have discovered that fundamental residual uncertainties (compare Rittel, 1972) remain, despite the certainty created through processes which organise and reorganise space. This leads to the realization that full control is an impossible task, at least under some conditions within reality. To understand these fundamental uncertainties and the complexities underlying them, planners have to explore alternative views on reality and different ways of guiding spatial transformations. Planners will have to assemble frameworks to propose or to influence actions and behaviours within a highly complex world and its intrinsic uncertainties.

These understandings of a reality beyond certainty, control and regulation do not include metaphysics, such as religion, and the rules of an imaginary god. Nor do they build on Newtonian ideas of universally valid rules. These understandings consider the world as a system in a constant state of becoming, a world which is considered to be 'out of equilibrium', with flows and changes in which symmetry breaks become manifest. The system and its subsystems will continuously respond to each other and to external influences, seeking a better fit with each other while adapting to their environment, leading to spontaneous and unexpected results. These processes of self-organisation within a system are regarded as adaptive processes at lower subsystem levels, which themselves also self-organise internally and so on. This special issue will further explore and promote this abstract reasoning and the debate surrounding it, to uncover the key mechanisms of self-organisation in support of our understanding of spatial development and methods for influencing this development.

2) Self-organising behaviours in urban systems

The concept of self-organisation generally asserts that spontaneous and autonomous changes are the driving forces behind aggregate patterns in natural and social systems. Its specific manifestation, however, can vary between different scientific domains. This special issue analyses different self-organising behaviours in urban systems, exploring how processes of self-organisation are detected and how self-organisation processes can be employed within a planners' environment, thus relating the abstractions of self-organisation and real-life examples in cities and urban regions. The specific illustrations and interpretations will allow planners and policymakers to enhance their understanding of the dynamics of the world they operate in. The exploration of self-organising behaviours will focus on cities and their neighbourhoods in analysing different change processes, new urban growth patterns, patterns of decline and urban regeneration, and the various dimensions of the relationship between planning and its instruments, processes and policies, etc.

3) Interdependencies between self-organisation and institutions

The concept of self-organisation can help explain the unexpected pace, direction and nature of changes in urban systems. As a consequence, this concept of self-organisation questions the role of formal institutions, which are by and large conservative in nature, and not likely to improve themselves unless alternatives have proven their value beyond doubt. This means that we have to clarify what kind of institutional setting would be able to deal with and respond to self-organising processes, how its tools, instruments and rules will need to be reconstructed, how this setting can enhance institutional design, and how the various actors and their responsibilities will have to be reconsidered.

From a liberal perspective, it can be tempting to frame self-organisation as a spontaneously emerging order which 'by nature' delivers superior outcomes and with much greater efficiency than processes 'distorted' by planners. In this special issue, we will argue that self-organisation is not the opposite of planning. We consider self-organisation and controlled organisation as parts of a continuum which represents realities with various combinations of the two extremes. It is up to the planner to present arguments on what the consequences are of such combinations under the conditions of a particular situation: induced intervention, influencing and guiding a more or less autonomous process, or some kind of combination of these two. This question relates closely to institutional design and therefore the set of papers here pay special attention to the role of institutions in processes of self-organising urban development.

Self-organisation in the context of planning practices

These papers elaborate on self-organisation and planning in the context of cities and their neighbourhoods. They explore understandings of urban development processes which pay particular attention to the spontaneous nature of change. These understandings are derived from different empirical contexts, and are related to different institutional frameworks and forms of planning. The collection of papers includes case studies from Europe and China, and address issues such as informal settlements, cohousing and urban renewal.

The authors of the papers are members of the Thematic Group on Planning and Complexity of the Association of European Schools of Planning (AESOP). This Thematic Group was founded in 2005 to explore linkages between spatial planning, non-linearity and the complexity sciences (Rauws, 2014).[1] The results of the collaborations in this group include the editorials 'A planner's encounter with complexity' (De Roo & Silva, 2010) and 'Complexity & Planning: Systems, Assemblages and Simulations' (De Roo et al., 2012).

This SpecialIssue starts with a contribution by Boonstra, analysing the development pathway of two co-housing initiatives. The paper begins with the observation that civil

[1] More information on AESOP's Thematic Group on Planning and Complexity can be found on http://www.aesop-planning.eu/blogs/en_GB/planning-and-complexity.

initiatives do not necessarily follow predefined planning procedures. Instead, these initiatives go down paths which are quite similar to self-organisation processes. This article brings together ideas from complexity theory, actor network theory and assemblage theory. It proposes four types of behaviour visible in self-organisation processes: decoding, expansion, contraction and coding. Supported by two Danish cases, self-organisation is redefined as actor-relational networks which emerge from interactions between human and non-human actors. These interactions result in a best fit between the 'self' of the initiative and its environment, within which it can materialize as a new assemblage in space.

In the paper 'Civic initiatives in urban development: self-governance versus self-organisation in planning practice', Rauws discusses two distinct interpretations of self-organisation: self-organisation in relation to do-it-yourself initiatives by citizens, which he refers to as self-governance, and the complexity-based understanding of self-organisation. Supported by two Dutch cases of urban development, this paper points out that self-organisation is concerned with the spontaneous emergence of urban transformation stemming from uncoordinated and relatively independent actions from which collective intent is absent. Meanwhile self-governance focuses on citizens and other non-governmental actors steering urban development processes collectively and in relative autonomy from governmental actors. The paper concludes by discussing how these different interpretations of self-organisation affect policy recommendations on how public planners should deal with civic initiatives.

Zhang and De Roo show that self-organisation processes are relevant even in China, with its strong state control of urban development. Their case study of transformations in the city of Beijing at the neighbourhood level reveals the unique characteristics of a self-organising process which include triggers, symmetry breaks and pattern formations. This paper also shows that self-organisation sometimes runs counter to socially desired outcomes, which assures us of the need and the desire for having spatial planning perspectives to hand. Finally, the paper shows that self-organisation and intentional behaviour are not necessarily mutually exclusive. These findings contribute to the ongoing and rapidly developing theoretical debate on self-organisation within the urban environment.

The paper by Silva and Farrall focuses on the interdependency between self-organisation and institutions in the context of the informal city. It analyses the rise of informal settlements in Portugal between the early 1960s and 1995. By incorporating the concepts of self-organisation and co-evolution, the paper draws attention to how interactions between illegal occupations and local authorities and the national Parliament shaped how Portugal dealt with unplanned urbanization. Attempts to make informal settlements an integral part of the city resulted in a national experiment on alternative spatial management models and eventually the implementation of a new national law; the AUGI Act. The central argument of the paper is that planners have to become more sensitive to the dynamic and evolutionary way in which these new development practices come about. It suggests that the design of strategies and tools that stimulate experimentation and which are responsive to processes which include

both planned interventions and spontaneous change can contribute to such enhanced sensitivity.

The Special Issue concludes with a contribution from Levi examining the potential of agent-based models in enhancing our understanding of spontaneous pattern formation in urban development. Agent-based modelling (AMB) is an often-used starting point for reasoning about self-organisation and spatial planning as it aims to explain processes that contribute to the emergence of macro-level structures or patterns out of the decisions and behaviour of agents at the micro level. After systematically analysing the criticism of ABM as well as its advocated strengths, Levi concludes that ABM is particular well suited to supporting the exchange of views on urban transformation processes between practitioners, policymakers and academics. She highlights that, in comparison with more traditional forms of modelling, ABM forces modellers to be more explicit in their assumptions about the systems they model, ABMs are more transparent in the implications of these assumptions, and that the validation problem of ABM fosters dialogues between planning theorists and planning practitioners.

A future research agenda

Together, the contributions to the Special Issue deliver valuable insights into the characteristics of the self-organisation processes at the neighbourhood and city level. Firstly, these contributions create a better understanding of how actors and their perceptions, ambitions and interactions, contribute to various bottom-up driven urban transformations. Second, the contributions point out that applying the idea of self-organisation to socio-spatial systems and networks rather than the hard sciences brings with it new challenges. Self-organisation in socio-spatial systems and networks includes agents with the capacity to reflect on their own behaviour and consider the possible consequences of their future actions (see also Portugali, 2011). Third, self-organisation in socio-spatial systems is, by definition, constrained by social values and norms which people create themselves.

The contributions in this Special Issue suggest that self-organisation is a fundamental driving force of urban transformation, including land use changes, the formation of economic agglomerations and the construction of new urban fabric. They also show that society can perceive the spontaneous patterns which result from self-organisation processes both positively and negatively. This provides an argument for looking at ways to influence self-organisation processes. In this context this Special Issue presents examples of how planners and policymakers can benefit from the interdependence between self-organisation and spatial institutions to better serve a social agenda.

Meanwhile, questions for further research are raised. How should symmetry breaks and criticalities in socio-spatial environments – to which breaks and the moment these breaks release their energy relate, and out of which adjustment behaviour and pattern formation

emerge – be identified? Can the effects of adjustment behaviour and pattern formation only be understood in retrospect or are there ways to understand the emergence of these processes and to rationalize their possible consequences a priori? Does the idea of coding, decoding, expansion and contraction offer a helpful framework for analysing interactions between self-organising processes and institutions in a broad range of planning issues? Gaining further understanding of how planners can improve their ability to anticipate the non-linear development paths of self-organising systems and networks is particularly important for planning practice. To what extent can the insights gained about the drivers underlying self-organisation be used for the development of spatial plans and planning strategies which accommodate self-organisation, cleverly utilizing a city's intrinsic capacity to adapt to changing circumstances? The in-depth exploration of how self-organisation can enrich a planner's understanding of the development of cities and their own role in these development processes has only just begun.

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